



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification⁶ :

A47C 27/08, 27/10, 7/02

A1

(11) International Publication Number:

WO 98/29010

(43) International Publication Date:

9 July 1998 (09.07.98)

(21) International Application Number: PCT/US97/20183

(22) International Filing Date: 3 November 1997 (03.11.97)

(30) Priority Data:

08/778,303

2 January 1997 (02.01.97)

US

(71)(72) Applicant and Inventor: GRAEBE, Robert, H. [US/US];
7 Persimmon Ridge Drive, Belleville, IL 62223 (US).

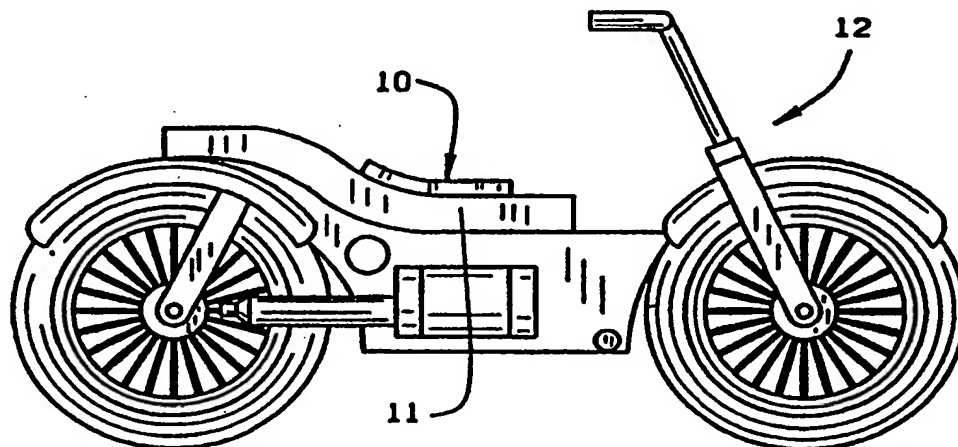
(72) Inventor; and

(75) Inventor/Applicant (for US only): FAIST, Stephen, E.
[US/US]; 155 Lake Lorraine Drive, Swansea, IL 62226
(US).(74) Agent: BRUNS, William, G.; Polster, Lieder, Woodruff &
Lucchesi, 763 South New Ballas Road, St. Louis, MO
63141 (US).(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR,
BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE,
GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK,
LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO,
NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR,
TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH,
KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ,
BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE,
CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL,
PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN,
ML, MR, NE, SN, TD, TG).

Published

With international search report.

(54) Title: MOTORCYCLE SEAT CUSHION



(57) Abstract

A cushion (10) for a motorcycle (12) or other seating surface. The cushion (10) has an octagonal shape with the rear area (R) being wider than the front (F) and the front (F) being longer than the rear (R). The cushion (10) has an inner cell pad (16) formed of pneumatically interconnected flexible upstanding cells (18) on a flexible base (17) and a fill tube (19) accessible by the user through an opening (14) in a cover (13) which is made from a smooth low friction top surface (50) to hold the user and a high friction bottom (51) to anchor the cushion (10) to the conventional seat (11) of a motorcycle (12) or the like.

Best Available Copy

Best Available Copy

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav	TM	Turkmenistan
BF	Burkina Faso	GR	Greece		Republic of Macedonia	TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's	NZ	New Zealand		
CM	Cameroon		Republic of Korea	PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

MOTORCYCLE SEAT CUSHION

Technical Field

This invention relates to motorcycle seat cushions and more particularly
5 to a free standing pad which can be placed on existing motorcycle seats and
which can be removed and carried with the user, but which remain firmly
anchored in position on the seat when in use.

Motorcycles are generally provided with seats for either a single person,
called a "solo" seat or a "dual" seat for both the rider and a passenger. When
10 dual seats are provided, the passenger seat is positioned behind the rider's seat
and extends over the front portion of the rear fender. When solo seats are
employed, the rear fender remains generally uncovered.

The removable motorcycle seat cushion of this invention can be
positioned on either a solo or dual seat cycle.

15

Background Art

Many motorcycle owners use their bikes for long distance travel often
over back roads which are not smooth and tend to give the user and/or the
passenger a bumping bouncy ride with much vibration. This is known to result
20 in stiffness and soreness in the user, accompanied by lower back pain,
hemorrhoidal irritation and extreme fatigue, and gathering of the undergarments
("wedgies"). There are a number of products on the market which strive to
obviate these problems. These include covers for seats made of sheepskin sold
as MUSTANG WOOLEES; replacement seats with inflatable air chambers sold
25 as MUSTANG AIRLIFT SEAT seats; an inflatable pad known as POCKET P-
PAD sold by XZOTIC Cycle Products; gel filled pads such as BUTT BUFFER
sold by Warner Associates and SADDLE GEL sold by Travelcade; and spongy
foam seats sold as JET STREAM and WIND TUNNEL by Wind-Tech
Engineering.

These all differ from the present invention which uses the unique DRY FLOATATION wheelchair cushion and therapeutic mattress technology of Roho, Inc. to provide a cushion which reduces fatigue and related problems in long, often bumpy motorcycle journeys.

5 It is a principal object of this invention to provide a new and improved motorcycle seat cushion and, in particular to provide a cushion usable with both solo and dual seat cycles. It is another object to provide a motorcycle seat which, although stable and firmly fixed in use, can be carried intact with the user when leaving the cycle.

10 A further object is to provide a motorcycle seat cushion which can be placed on the seats of existing cycles without their modification and which comprises an air cell pad formed with interconnected upstanding flexible air cells and a cover which has a smooth top surface to facilitate user transfer on and off the cushion and a friction generating bottom surface which retains the
15 cushion in a predetermined position on the seat of the motorcycle.

These and other objects and advantages of the present invention will become more apparent from the detailed description thereof taken with the accompanying drawings.

In general terms, the invention comprises a motorcycle seat cushion for
20 mounting on the seats of existing motorcycles without special mounting arrangements. The cushion comprises an air pad encased in a cover having a smooth relatively friction-free seating area and a friction generating under surface to fix the cushion on the seat of the motorcycle. The air pad comprises a series of upstanding interconnected air cells to isolate the anatomy of the user
25 from vibration and shock and to provide uniform forces against that portion of the user's anatomy which rests on the cushion.

Brief Description of Drawings

In the drawings where like numbers refer to like parts wherever the
30 occur,

Figure 1 is a side elevational view of a motorcycle with the cushion of this invention placed on the seat thereof;

Figure 2 is a front, top, right side perspective view of the motorcycle seat of this invention;

5 Figure 3 is a front, top, right side perspective view of the air pad component of this invention;

Figure 4 is a fragmentary sectional view taken along line 4-4 of Figure 3;

Figure 5 is a bottom view of the cushion of this invention;

10 Figure 6 is a side elevational view;

Figure 7 is a rear elevational view;

Figure 8 is a top plan view of the air cell shown in Figure 3;

Figure 9 is a right side elevational view of the air pad of Figure 8;

Figure 10 is a rear elevational view of the air pad of Figure 8;

15 Figure 11 is a vertical sectional view taken along line 11-11 of Figure 5;

Figure 12 is a vertical sectional view taken along line 12-12 of Figure 8;

Figure 13 is a vertical sectional view taken along line 13-13 of Figure 8;

Figure 14 is an enlarged fragmentary plan view of the back wall of the cover of the composite cushion of this invention;

20 Figure 15 is a vertical sectional view of a portion of the cover back wall shown in Figure 14;

Figure 16 is a plan view of the bottom wall of the air pad shown in Figure 3;

Fig. 17 is a plan view of a modification of the air pad; and

25 Fig. 18 is a right side elevational view of the air pad shown in Fig. 17.

As noted, corresponding reference numerals will be used throughout the several figures of the drawings.

Best Mode for Carrying Out the Invention

The following detailed description illustrates the invention by way of example and not by way of limitation. This description will clearly enable one skilled in the art to make and use the invention, and describes several
5 embodiments, adaptations, variations, alternatives and uses of the invention, including what we presently believe is the best mode of carrying out the invention.

Fig. 1 shows an elevational view of the composite motorcycle seat cushion 10 of this invention located on the seat 11 of a conventional "solo" motorcycle 12. Fig. 2 shows the motorcycle seat cushion 10 which includes a removable three piece octagonal shaped cover 13 having a reclosable opening 14 at its larger end 15.

Positioned inside the cover 13 is an air cell pad 16 which includes a base 17, a series of interconnected upstanding air cells 18 and a fill tube assembly 19.
15 This is shown in Fig. 3.

The cover 13 is similar in construction to the cover shown in Robert H. Graebe Patent No. 5,111,544 which is incorporated herein by reference as fully as if it were set out in its entirety.

The cellular cushion 16 embodies DRY FLOATATION® technology of ROHO, Inc. and the cells 18 themselves may be of a configuration shown in the
20 air pads described in Graebe Patent Nos. 5,369,828; 4,541,136, etc. The inflatable cushion or module 16 is octagonal in shape and, as shown in Fig. 4, comprises a flexible base sheet 20 which has an octagonal shape and a formed flexible top sheet 21 which has the air cells 18 formed therein. The two sheets
25 20, 21 are cemented together at preselected areas to form the module 16. The sheets 20, 21 preferably are formed of latex and the top sheet 21 is made by dipping a mandrel into liquid latex. A detailed disclosure of a suitable fabrication process and apparatus is disclosed in Graebe Patent No. 4,541,136 incorporated herein by reference as fully as if set out in its entirety.

The inflatable cellular cushion 16 also may be formed by vacuum or heat forming as set forth in Graebe Patent No. 5,561,875, or by molding in plastic such as polyvinyl chloride (PVC) or polyurethane.

The details of the air cell pad 16 are shown most clearly in Figs. 3, 8-12 and 16. The base 17 is of octagonal shape and comprises a front edge 25 and a longer rear edge 26. Side edges 27, 27a are parallel to each other and perpendicular to the front and rear edges 25, 26. Connecting the rear edge 26 to the side edges 27, 27a are diverging edges 28, 28a. Connecting the side edges 27, 27a to the front edge 25 are converging edges 29, 29a. The edges 28, 28a are shorter than the edges 29, 29a.

The air cells 18 are of pyramidal shape and have a square bottom, rectangular side edges 30, a tapered top formed of four inwardly inclined side walls 31 of substantially trapezoidal shape and a square substantially flat top 32. The purpose of the pyramidal shape is to provide a means to collapse the air cell in a controlled manner during the engagement phase by the person sitting on the points formed by the pyramid. The higher the point, the greater the engagement travel which gradually builds up the internal pressure of the cell giving a low force entry zone. This is useful to prevent bottoming out when the cycle is traveling over rough roads and the rider may bounce on the seat at frequent intervals.

The air cells 18 are spaced from each other by lateral and longitudinal passages and stand independently of each other when erected and filled with air.

The air cells 18 are configured in lateral rows and includes a rear array "R", a middle array "M" and a front array "F". The rear array "R" comprises three rows of cells 18 parallel to the rear edge 26 and spaced along the diverging edges 28, 28a. The rows are of diverging length from four cells 18 adjacent to the rear edge 26 to six cells 18 adjacent to the side edges 27, 27a. The middle array "M" comprises three rows of equal length which contain seven cells 18. The cell rows in the array "M" are parallel to the front and rear edges 25, 26 and perpendicular to the side edges 27, 27a. The array "M" also is coextensive with

the side edges 27, 27a. The front array "F" comprises four rows of cells 18 parallel to the front edge 25 and spaced along the converging edges 29, 29a. The rows vary in length from six cells 18 adjacent to the side edges 27, 27a to three cells 18 adjacent to the front edge 25. This configuration allows the
5 cushion 10 to be positioned on a motorcycle seat with the rear array "R" supporting the user's back, coccyx and ischia, and the center and front arrays "M" and "F" supporting the ischia and trochanters of the user.

The air cells 18 are interconnected pneumatically by a series of air passages in the base 17. The air passages include a first peripheral or
10 circumferential series of passages 35 which connect the air cells 18 that are around the periphery of the air cell pad 16 (Figs. 8, 12 and 16), and a second lateral or transverse series of passages 36 which extend from side to side parallel to the front and rear edges 25, 26 and connect the air cells 18 in each row (Figs. 8, 11 and 16). Thus all of the air cells 18 are interconnected
15 pneumatically. An alternative construction is to eliminate two or more of the air passages 35 to form separate air chambers each of which would be provided with a fill tube assembly 19 (Figs 17,18). A further modification is to provide a manifold type on-off valve arrangement as shown in Graebe Patent Nos. 5,163,196 and 5,502,855. The areas of the base 17 between the air cells 18 are
20 cemented together (Fig. 13). The end result is that the areas of the bottom sheet 20 that form the bases 37 of the cells 18 tend to bulge outwardly or downwardly (Figs. 9, 10, 13) when air is in the cells 18 and when the cushion is not on a smooth surface.

Another feature of the air cell pad 16 is the fill tube assembly 19 which
25 is connected to the outside side wall 38 of the outermost air cell 39 in the second row of air cells in the rear array "R". An outwardly projecting cylindrical sleeve 40 is molded into the air cell wall 38 and one end of a relatively stiff tubular member 41 is cemented into the sleeve 40. The tubular member 41 has an angularly inclined leg portion 42 designed to parallel the base
30 edge 28. Connected to the end of the leg 42 is a fill nozzle 43 having a rotatable

on-off valve 44. A hold down member 45 forms a loop 46 through which the leg 42 is loosely positioned (Fig. 10). The hold down member 45 is fastened to the air pad base 17 by a rivet 47 or other suitable fastener. The purpose of the retainer 45 is to position the nozzle 43 so that it is accessible to the user through the cover opening 14. The cover 13, as mentioned, contains subject matter in common with Graebe U.S. Patent No. 5,111,544.

The flexibility of the base 17 allows it to fit over and conform to the often irregular shape of motorcycle seats, autos, truck or boat seats and saddles.

The cover 13 fits over the seating surface formed by the dome-shaped ends of the cells 18, and also along the sides of the peripheral cells and under the base 17, generally encapsulating the pad 16. Yet, it does not impair the effectiveness of the pad 16, for the ends of the cells 18 are easily displaced toward the base to conform to the shape of the user's buttocks and the base 17 can conform to the shape of the motorcycle seat 11 or other seating surface to which it is applied. Moreover, the cover 13 is easily stripped from the pad 16 to enable the two to be cleaned separately.

The cover 13 includes a top panel 50, a bottom panel 51 and a side panel 52 which extends between and is joined to the top and bottom panels 50 and 52 along stitch lines 53. Both the top and bottom panels 50 and 51 are octagonal in shape, and that shape matches the shape of the pad base 17. The side panel 52 is of a height that generally corresponds to the height of the cells 18 when they are fully extended. The stitch lines 53 connecting the lower panel 51 and the upper panel 50 to the side panel 52 extend along the full periphery of the cover and are continuous in the sense that no interruptions exist in the seam that they form. The side panel 52 is severed into two sections 54, 55 for a portion of its length around the rear edge 26 and the diverging edges 28, 28a. The sections 54, 55 carry a zipper 56 which normally joins them together as one.

The top panel 50 preferably is formed from a highly elastic and porous fabric, i.e., one that stretches in any direction. The elasticity of the top panel 50 enables that panel to conform to the shape of the user's buttocks when the user

sits upon the cushion 10. The top panel 50 simply follows the contour of the seating surface created by the cells 18 and imposes minimum shear on the user's skin. It detracts little from the capacity of the array of air cells 18 to conform to the shape of the user's buttocks. The top panel 50 is porous to vent away moisture. Plastic sheet material for the top panel 50 that has limited elasticity may be used when very good vapor permeability is desired, e.g., when limited cooling is desired.

The bottom panel 51, on the other hand, is formed from a high friction material, such as the illustrated high friction mesh 60 (Figs. 13 and 14) known as vinyl coated scrim. The mesh 60 consists of polyester fibers woven into an open weave and a polyvinyl chloride coating covering the polyester fibers without obliterating the openings of the weave. The weave is such that the mesh 60 has relatively thick ribs 61 extending parallel between opposite edges of the panel 50 and thinner connecting segments 62 extending between the ribs 61 and oriented at right angles with respect to the ribs 61, with the spacing between the connecting segments 62 being about the same as the spacing between the ribs 61. This forms a pattern of square openings, which are divided by diagonal segments 63 that extend between the connecting segments 62, and cross at the centers of the square openings. The coating has a high coefficient of friction against traditional seating and saddle surfaces such as leather, vinyl, wood, metal or fabric, and the friction that develops is particularly effective along the thick ribs 61. The coefficient of friction between the coating and such surfaces is substantially greater than the coefficients of friction between the upper and side panels 50 and 52 and such surfaces. The mesh 60 is commonly used as an underlayment for throw rugs to prevent them from slipping on traditional flooring materials such as tile, vinyl and hardwood. It may be obtained from Vantage Industries, Inc., of Atlanta, Ga., or other suitable sources. The high friction mesh 60 of the bottom panel 52 prevents the cover, and the cushion over which it fits, from sliding around the motorcycle seat 11. In addition, it admits air to the interior of the cover 13 where the air can circulate

through the array of air cells 18. Finally, it permits moisture to drain from the interior of the cover 13, when drain holes 65 are provided in the base 17 of the cushion between the cells 18.

The bottom panel 51 also may have other mesh patterns and may even
5 be a solid sheet of neoprene rubber or the like which would make the cushion warmer for cold weather use.

The side panels 52 are formed from a more traditional fabric, i.e., one that has considerable flexibility, yet does not stretch easily. Typical nylon fabric is suited for this purpose.

10 Figs 17 and 18 illustrate a modification of the invention in which the air cell pad 16A is divided into compartments "A", "B" and "C". In the embodiment shown, the rear array "R" and the middle array "M" and the adjacent row of cells in the front array are all at about the same inflation even though the middle array "M" and the rear array "R" are separated and inflatable
15 through separate nozzles designated by the numerals 43a and 43b. The front array "F" also is separated from the other two and is more highly inflated so that the air cells 18 are distended outwardly and upwardly (Fig. 18). The fill nozzle 43c is used to fill the cells in the front array "F". In use, when the cell pad 16A is placed on a motor angle seat, the raised front cells "F" tend to engage the user
20 if the cycle stops suddenly and to hold and restrain the user from sliding off the seat. This adds to the safety of the cushion 10. Other combinations of air cell sections can be used depending on the result desired.

In view of the above, it will be seen that the several objects and advantages of the present invention have been achieved and other advantageous
25 results have been obtained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Claims

1. A composite seat and saddle cushion comprising:
 - a) a flexible modular air cell pad having a flexible base and a series of upstanding air cells having side walls and a top surface, said air cells being
5 formed in lateral transverse rows, some of the rows having a different number of air cells from other of the rows, at least some of the air cells being pneumatically interconnected, and
 - (b) a cover comprising:
 - (1) a top panel located over the upper ends of the cells and
10 being formed from an elastic fabric;
 - (2) a bottom panel located under the base and covering substantially the entire base, said bottom panel being formed from a high friction material; and
 - (3) a side panel located between and connected to the top and
15 bottom panels at the peripheral margins of the top and bottom panel, said side panel being formed from a flexible fabric, a portion of the side panel being divided into sections which are normally joined, but which may be detached to permit the cover to be removed from or fitted over the pad.
2. The cushion of claim 1 having an octagonal shape with one end
20 being wider than the other.
3. The cushion of claim 1 wherein the upstanding air cells have flexible generally vertical side walls sealed to the bottom wall, each of said air cells being substantially pyramidal in shape, and having a substantially rectangular shaped lower section defined by the flexible vertical side walls, and
25 a domed tapered upper section formed from side panels connected to the vertical side walls, the vertical side walls of adjacent cells being separated and spaced apart to define lateral and longitudinal paths and being independently upstanding when inflated.

4. The cushion of claim 1 wherein the air cells have substantially square flexible lower sections and the upper sections have substantially trapezoidal panels with substantially flat top areas.

5. The cushion of claim 1 wherein the cells are all interconnected
5 pneumatically through passages in the flexible base.

6. The cushion of claim 5 including air passages in the base connecting the cells around the periphery of the base and lateral air cells connecting the cells in each transverse row.

7. The cushion of claim 1 including at least one air fill assembly
10 connected to the side wall of a peripheral cell.

8. The cushion of claim 7 wherein the air fill assembly includes a fill tube positioned within the periphery of the pad base and parallel to one edge and having an on-off valve on the free end.

9. The cushion of claim 8 wherein the free end of the fill tube is
15 adjacent to the detachable side panel sections to provide the user of the cushion access to the fill tube.

10. The cushion of claim 2 wherein the air cell pad has a rear array, a middle array, and a front array of cells, with the number of cells in the rear array being less than the number of cells in the front array, and there being less cells
20 in the outermost row of cells in the front array than in the outermost row of cells in the rear array.

11. The cushion of claim 1 wherein the cover bottom is a high friction mesh.

12. The cushion of claim 11 wherein the high friction mesh is
25 flexible and has parallel ribs with thinner connecting segments extended between the ribs.

13. The cushion of claim 1 wherein the side panel is formed from a highly flexible but substantially non-elastic fabric.

14. The cushion of claim 1 wherein the air cell pad has drain holes in
30 its base.

15. The cushion of claim 9 including a tie down positioned around the air fill tube and anchored to the base of the pad to hold the air fill tube and nozzle in a position where it is accessible by the user of the cushion through the side wall panel segments.

5 16. The cover of claim 11 wherein the bottom panel is coated with polyvinyl chloride.

17. The cover of claim 1 wherein the side panel sections are joined by a zipper arrangement.

10 18. The cushion of claim 1 wherein the flexible base of the air cell pad and the cover allow the cushion to conform to and be retained on irregular seats and saddle surfaces.

19. A composite seat and saddle cushion comprising:

15 a) a flexible modular air cell pad having a flexible base of irregular shape and a series of upstanding air cells having side walls and a top surface, said air cells being formed in lateral transverse rows, some of the rows having a different number of air cells from other of the rows, the air cells being divided into arrays with the cells in each array being pneumatically interconnected, whereby each array can be inflated to a different degree than the other arrays, and

20 (b) a cover comprising:

(1) a top panel located over the upper ends of the cells and being formed from an elastic fabric;

25 (2) a bottom panel located under the base and covering substantially the entire base, said bottom panel being formed from a high friction material; and

(3) a side panel located between and connected to the top and bottom panels at the peripheral margins of the top and bottom panel, said side panel being formed from a flexible fabric, a portion of the side panel being divided into sections which are normally joined, but which may be detached to permit the cover to be removed from or fitted over the pad.

30

20. The cushion of claim 19 wherein the air cell pad base and the cover each have an octagonal shape with one end being wider than the other, the smaller end having a separate array of air cells located toward the front of the surface on which the cushion is located whereby it can have a greater inflation
- 5 to retard forward movement of the user of the cushion.

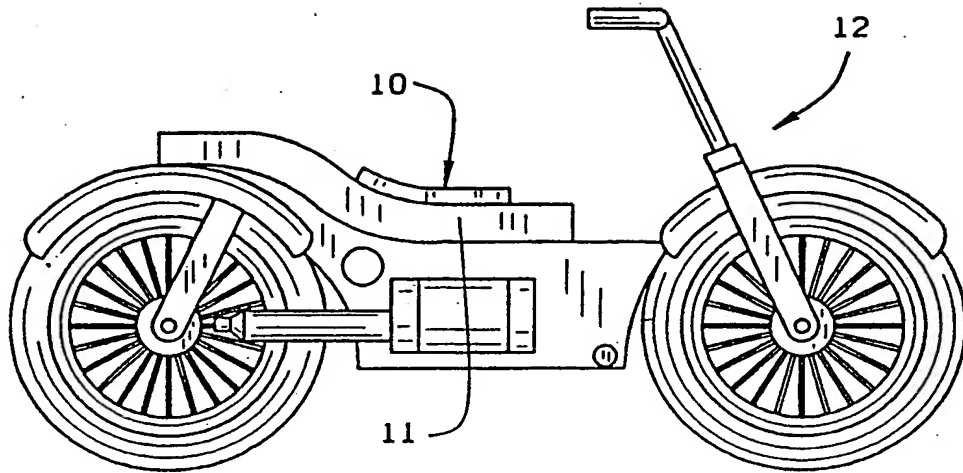


FIG. 1

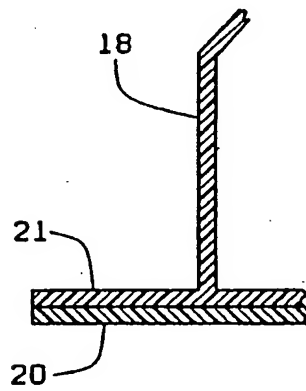


FIG. 4

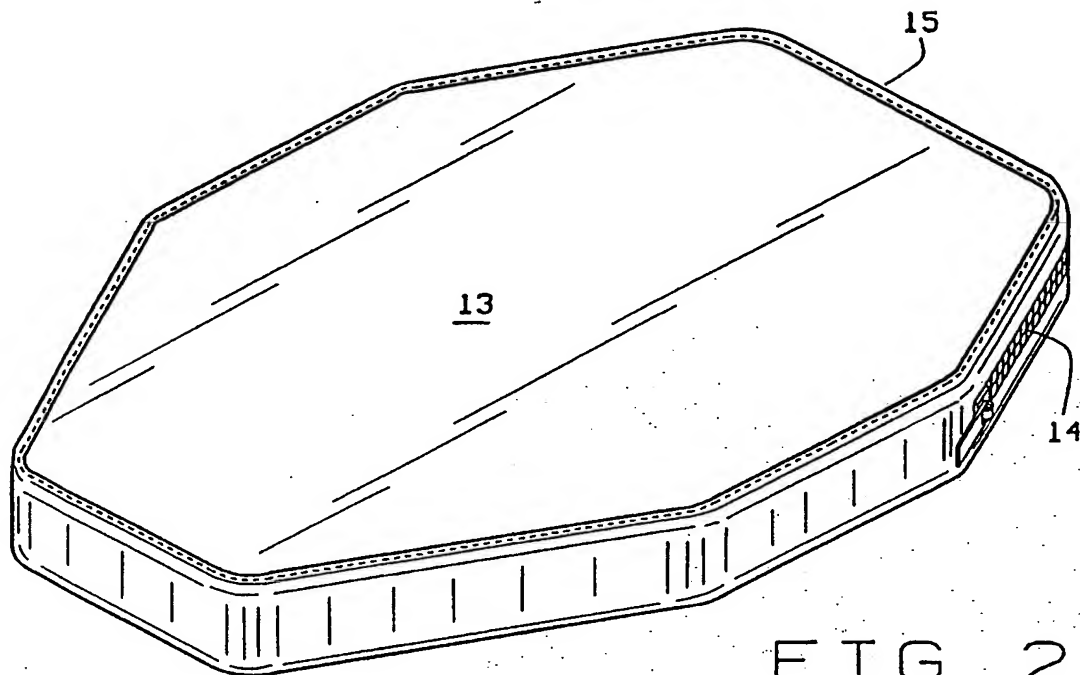


FIG. 2

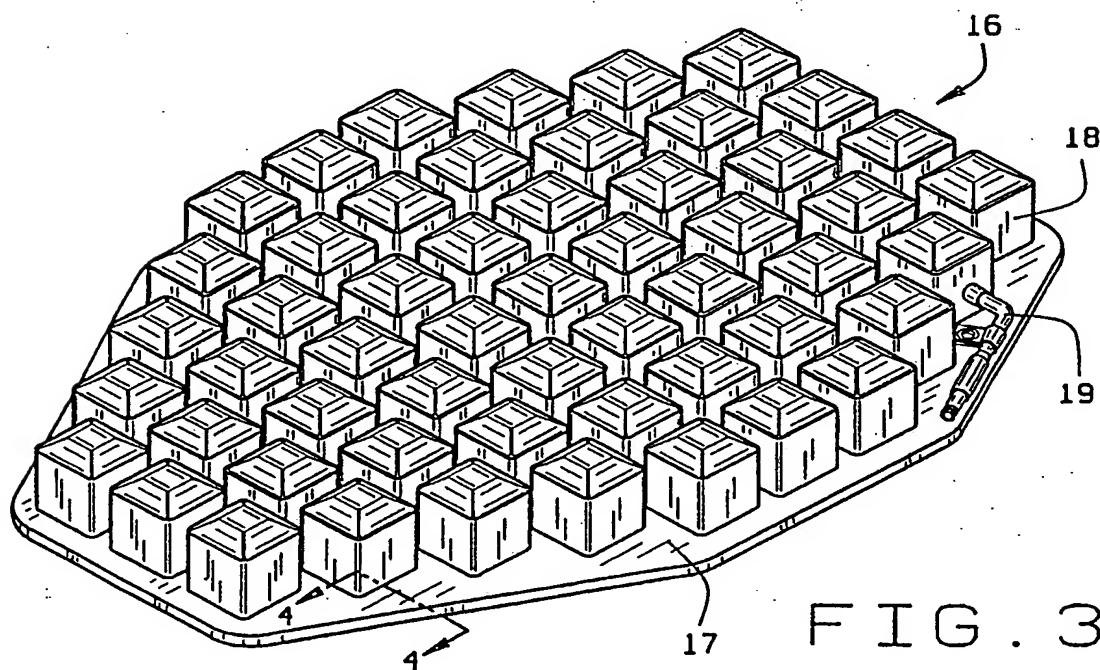


FIG. 3

claim
1

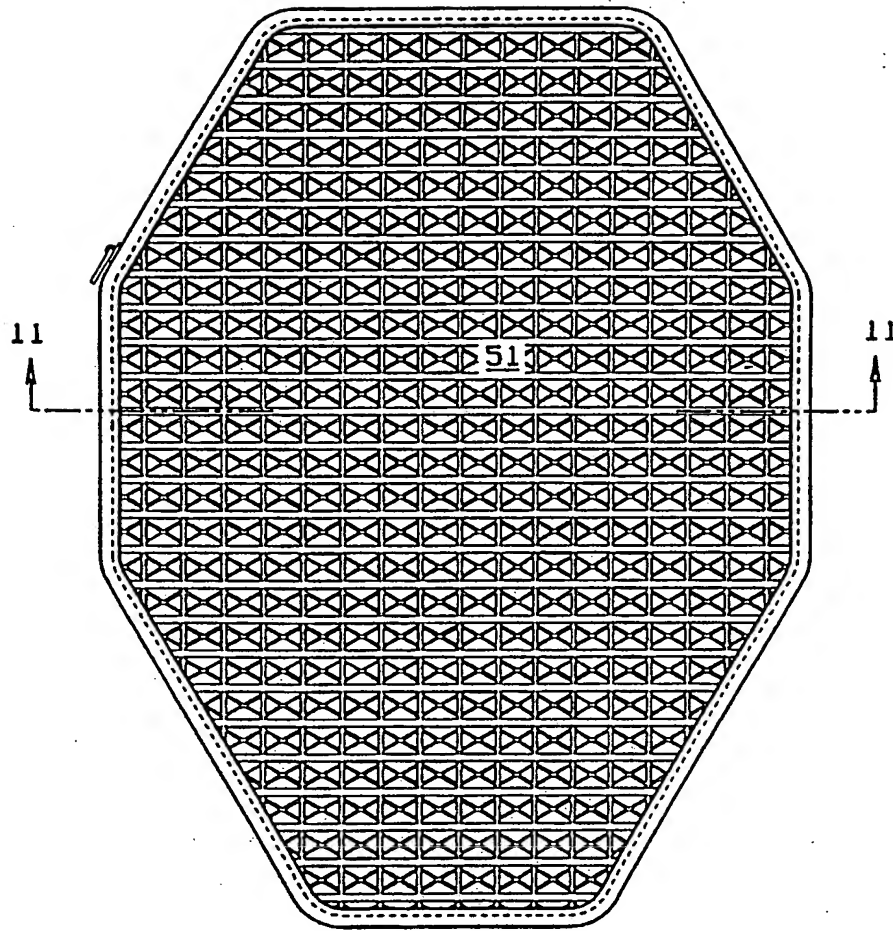


FIG. 5

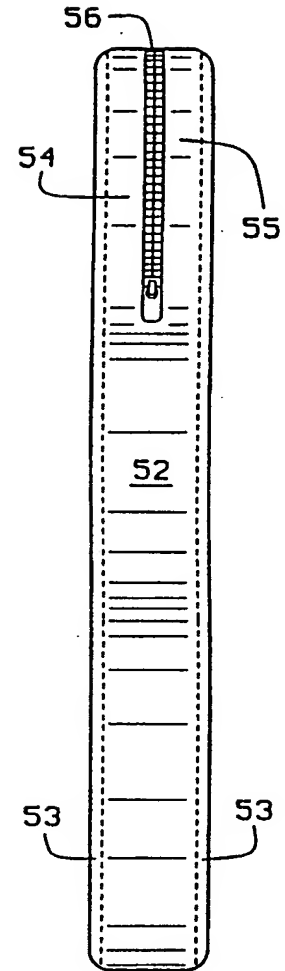


FIG. 6

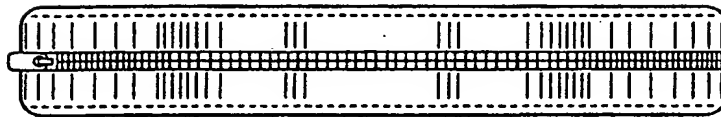


FIG. 7

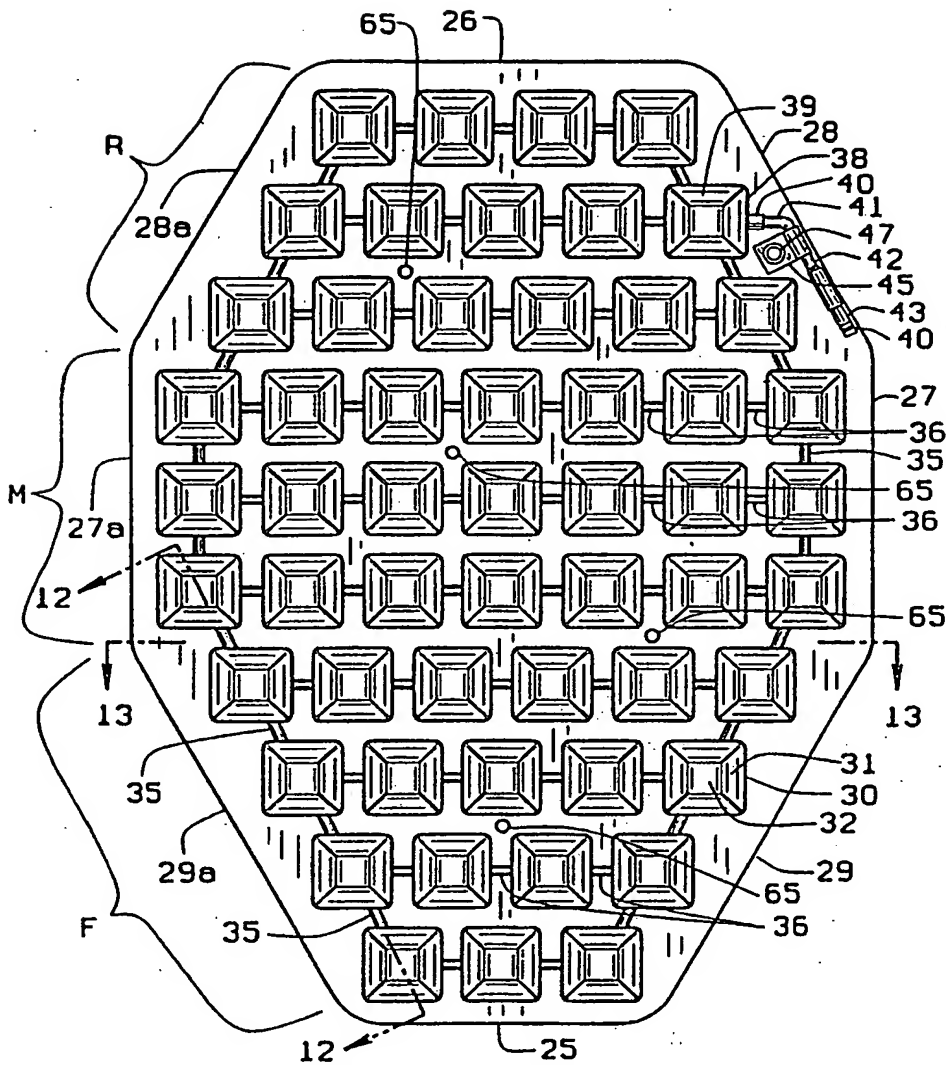


FIG. 8

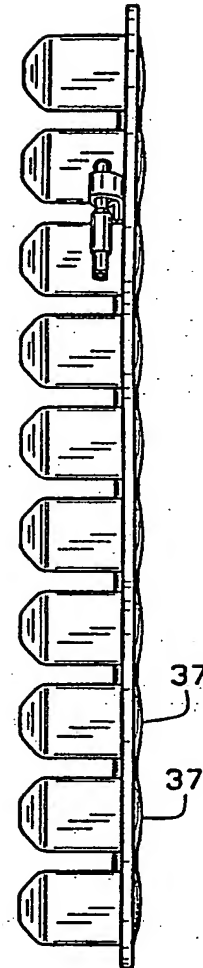


FIG. 9

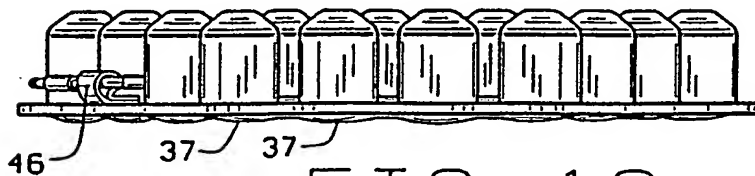


FIG. 10

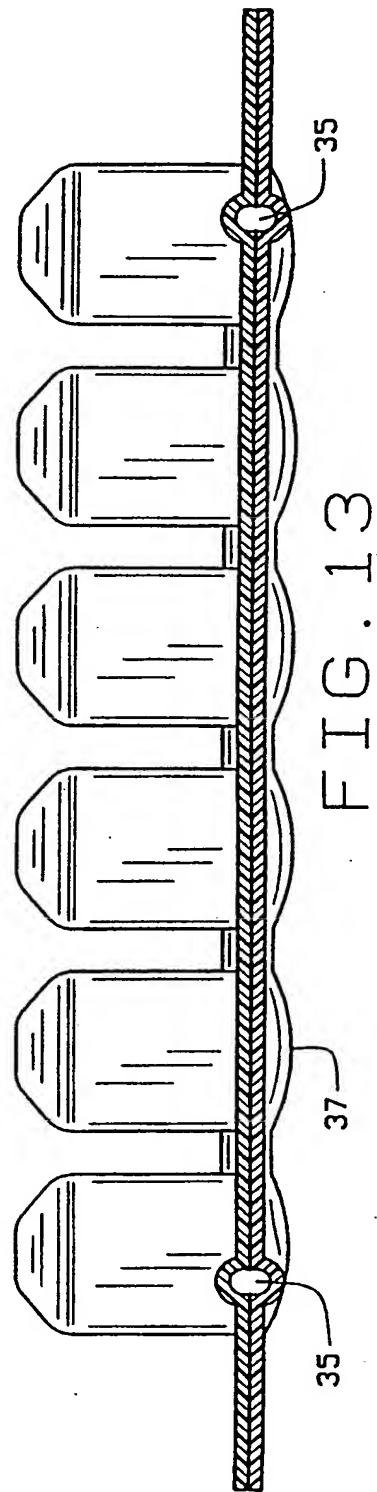
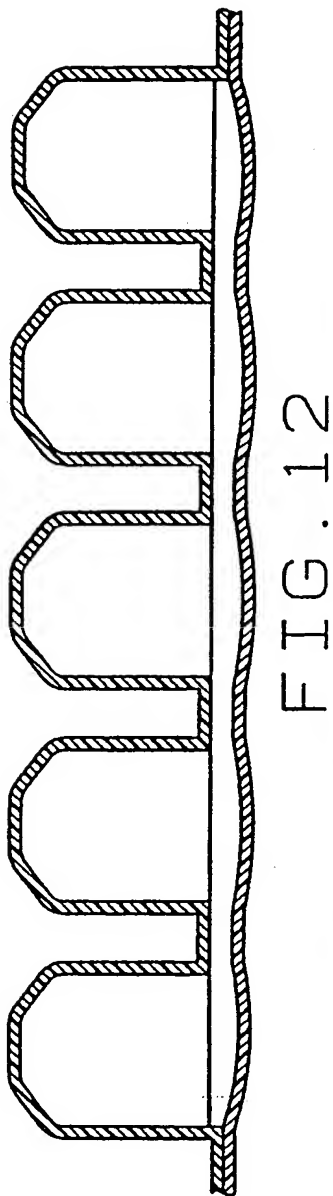
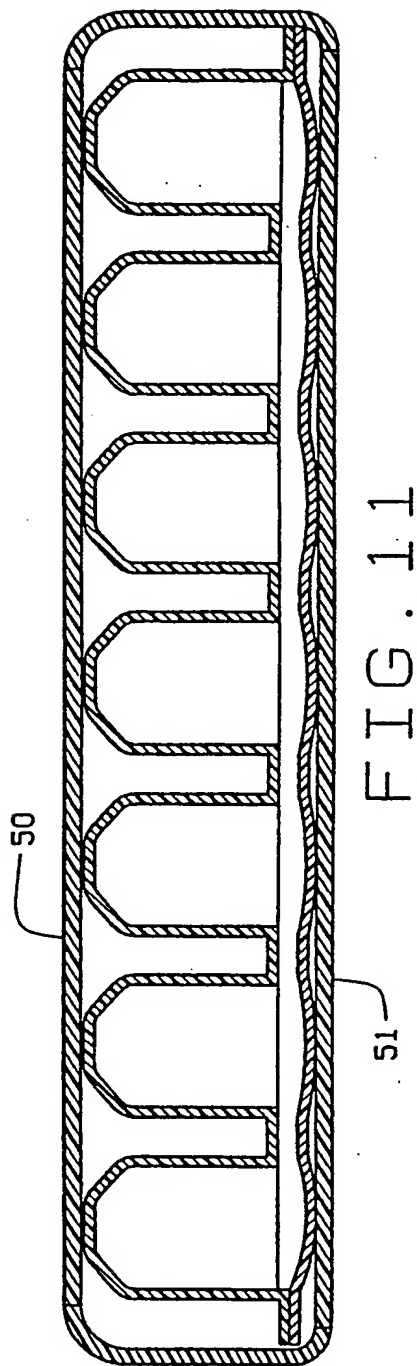


FIG. 14

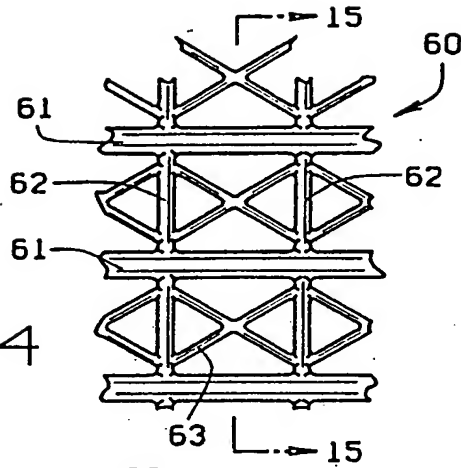


FIG. 15

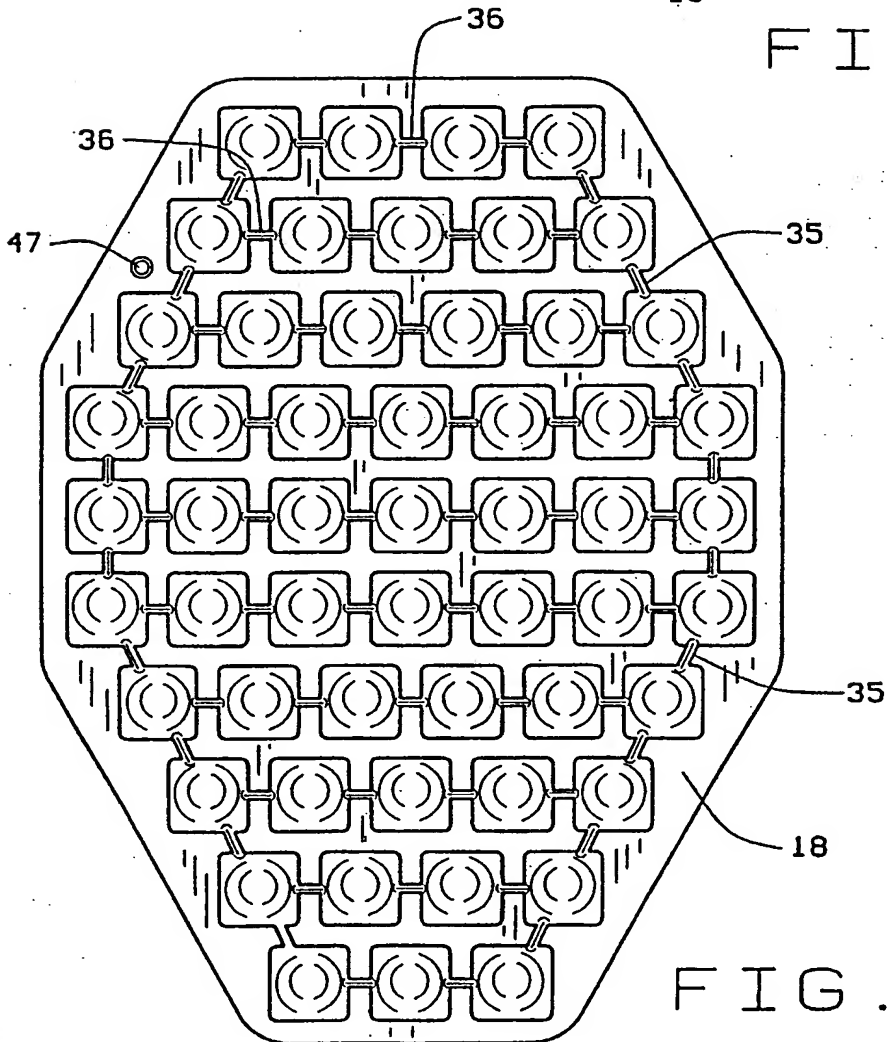
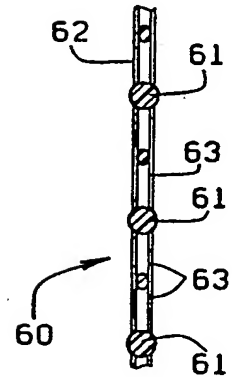


FIG. 16

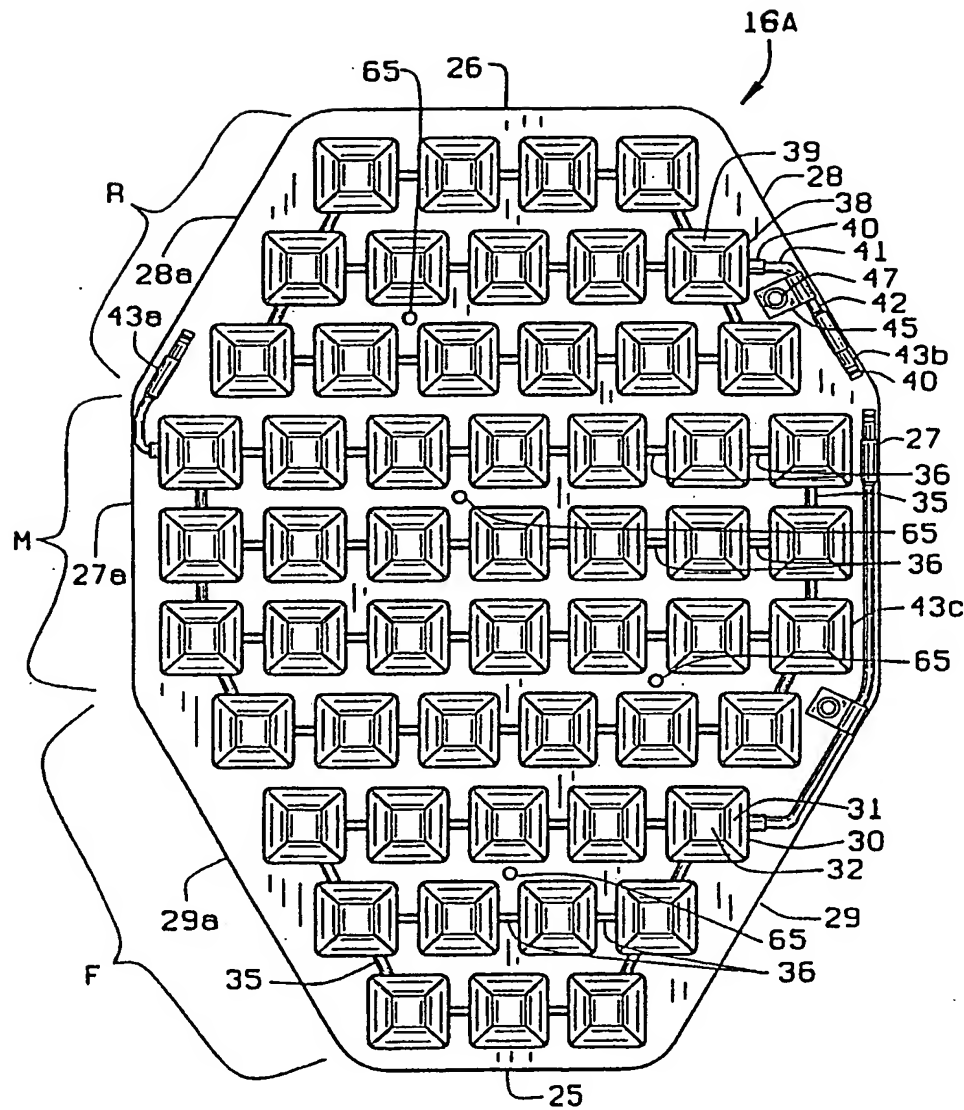


FIG. 17

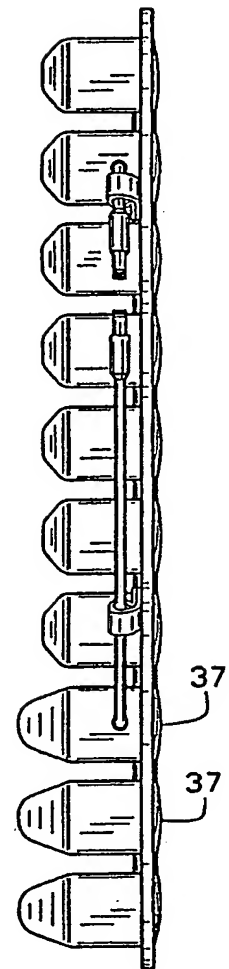


FIG. 18

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US97/20183

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A47C 27/08, 27/10, 7/02

US CL :5/654, 655.3, 710, 713, 737, 925; 297/219.11, 452.41, DIG 3

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 5/654, 655.3, 710, 713, 731, 737, 738, 925, 926; 297/218.1, 219.11, 228.13, 452.21, 452.41, DIG 3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 5,111,544 A (GRAEBE) 12 May 1992 (12/05/92), column 2, lines 9-14, 22, 31-36, 42-50, & 61-67, column 3, lines 10-11, 20-29, & 54-56, and column 4, lines 11-13 & 29-34.	1, 2, 5, 10-13, 16-18 ----- 1-20
Y	US 5,561,875 A (GRAEBE) 08 October 1996 (08/10/96), column 9, lines 1-29.	1-20
Y	US 5,369,828 A (GRAEBE) 06 December 1994 (06/12/94), column 3, lines 3-7, column 4, lines 11-20 & 50-53, and column 5, lines 45-49.	3, 4, 6-9, 15
Y	US 2,577,274 A (SAMPSON) 04 December 1951 (04/12/51), column 2, lines 11-15, column 3, lines 7-13.	14

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier document published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	
"P"	document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search

21 JANUARY 1998

Date of mailing of the international search report

26 FEB 1998

 Name and mailing address of the ISA/US
 Commissioner of Patents and Trademarks
 Box PCT
 Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

ROBERT G. SANTOS

Telephone No. (703) 308-2168

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/20183

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,698,864 A (GRAEBE) 13 October 1987 (13/10/87), column 2, lines 49-61.	19, 20
A	US 4,864,671 A (EVANS) 12 September 1989 (12/09/89).	5, 19
A	US 5,052,068 A (GRAEBE) 01 October 1991 (01/10/91).	5, 19
A	US 5,152,023 A (GRAEBE) 06 October 1992 (06/10/92).	2, 20
A	US 5,634,685 A (HERRING) 03 June 1997 (03/06/97).	1, 19
A	US 4,779,924 A (RUDEL) 25 October 1988 (25/10/88).	1, 19
A	US 3,253,861 A (HOWARD) 31 May 1966 (31/05/66).	14
A	US 3,503,084 A (MEINWIESER) 31 March 1970 (31/03/70).	2, 20
A	US 3,296,635 A (O'HANLAN) 10 January 1967 (10/01/67).	2, 20
A	US 2,343,996 A (PERRY) 14 March 1944 (14/03/44).	2, 20
A	GB 420,292 A (MOSELEY ET AL) 28 November 1934 (28/11/34).	2, 20

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☒ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.